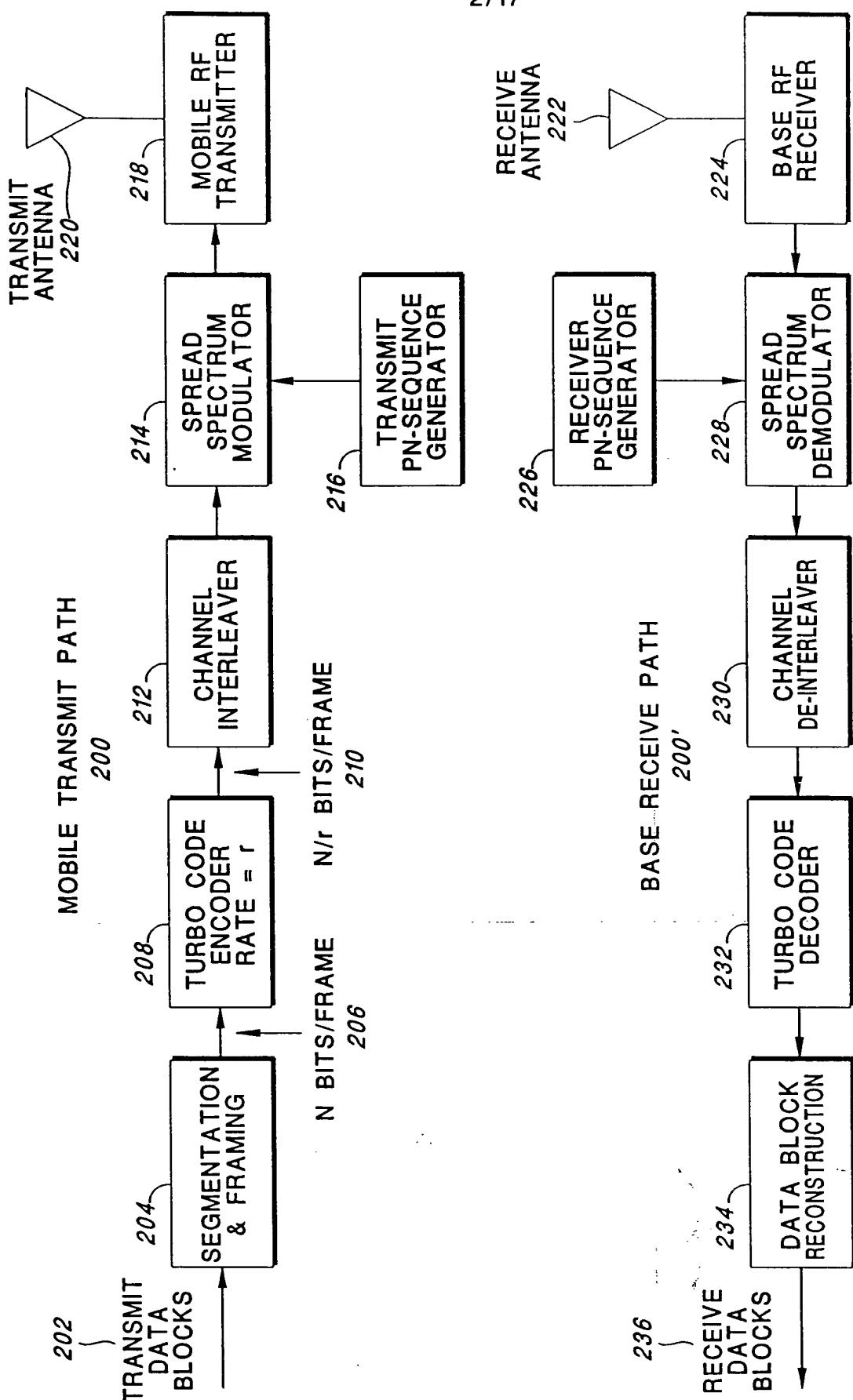


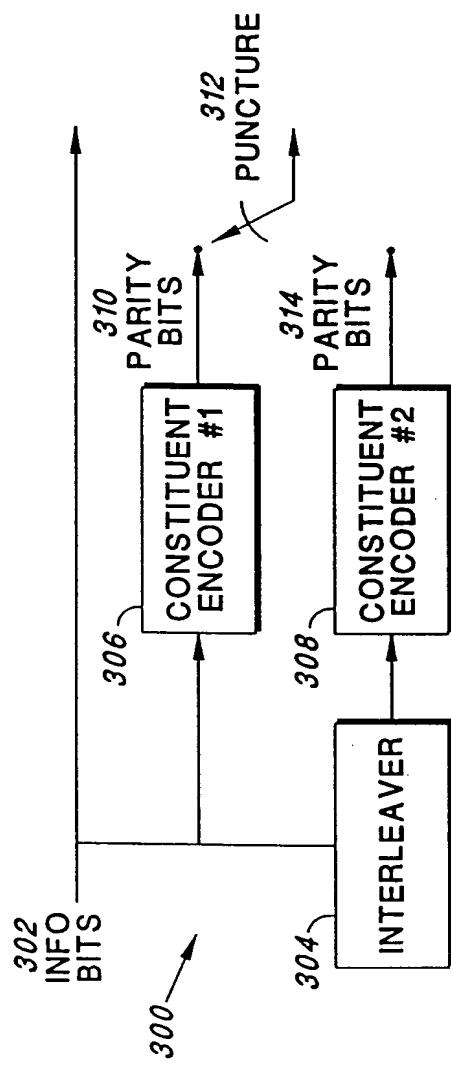
FIG. 1

BLOCK DIAGRAM OF A DIRECT SEQUENCE CDMA DIGITAL CELLULAR MOBILE TRANSMITTER AND BASE RECEIVER



EXAMPLE OF A CDMA COMMUNICATIONS LINK USING TURBO CODES

FIG. 2



GENERIC TURBO CODE ENCODER BLOCK DIAGRAM

FIG. 3

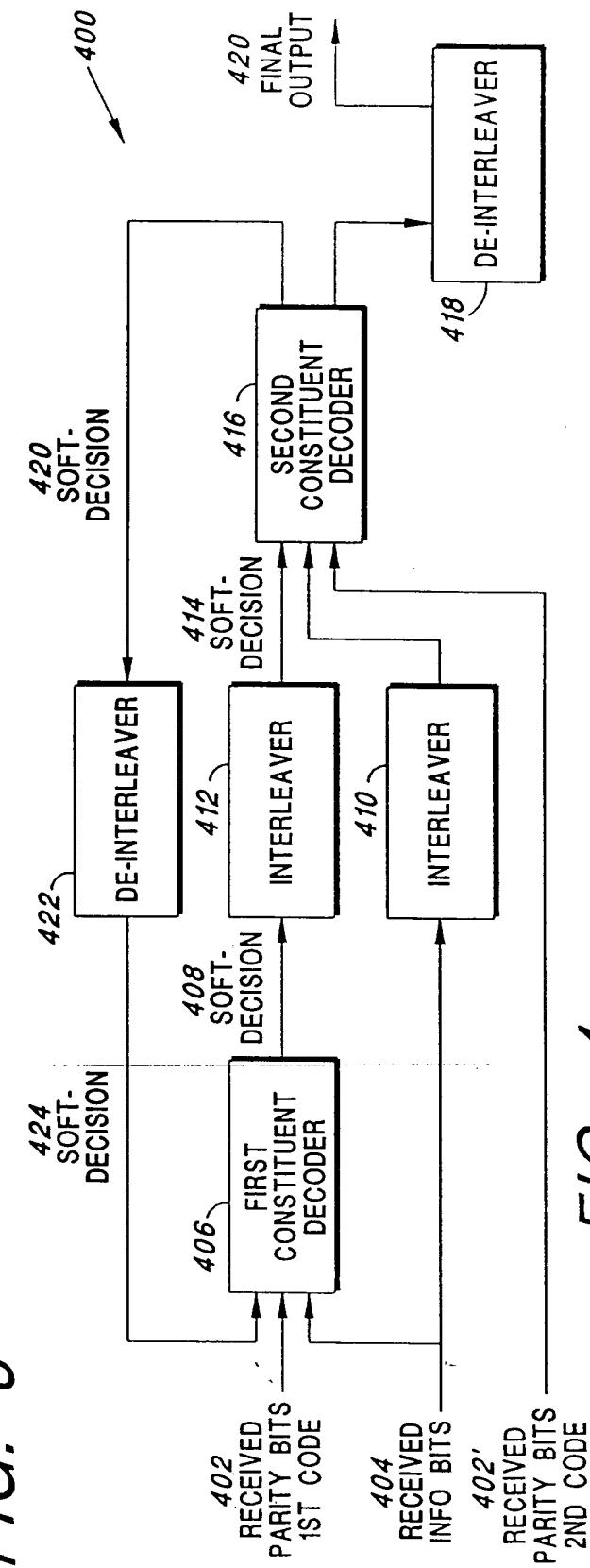
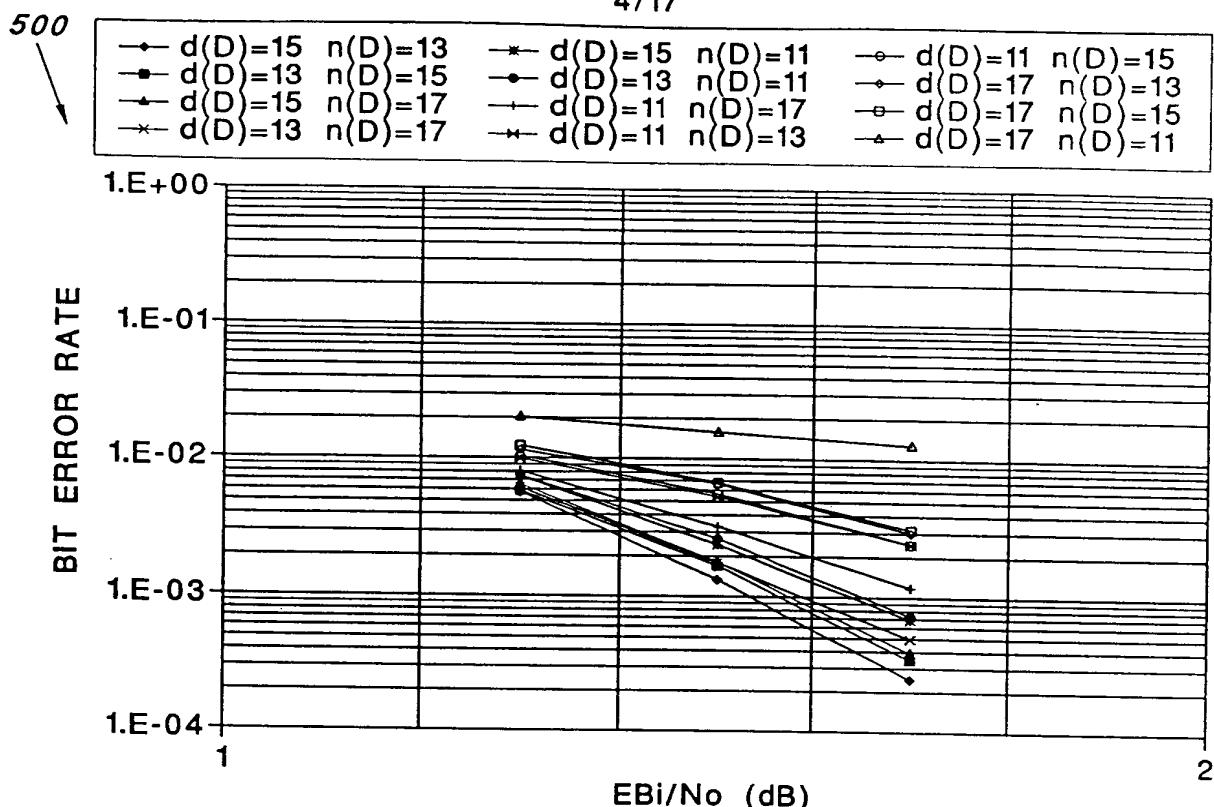
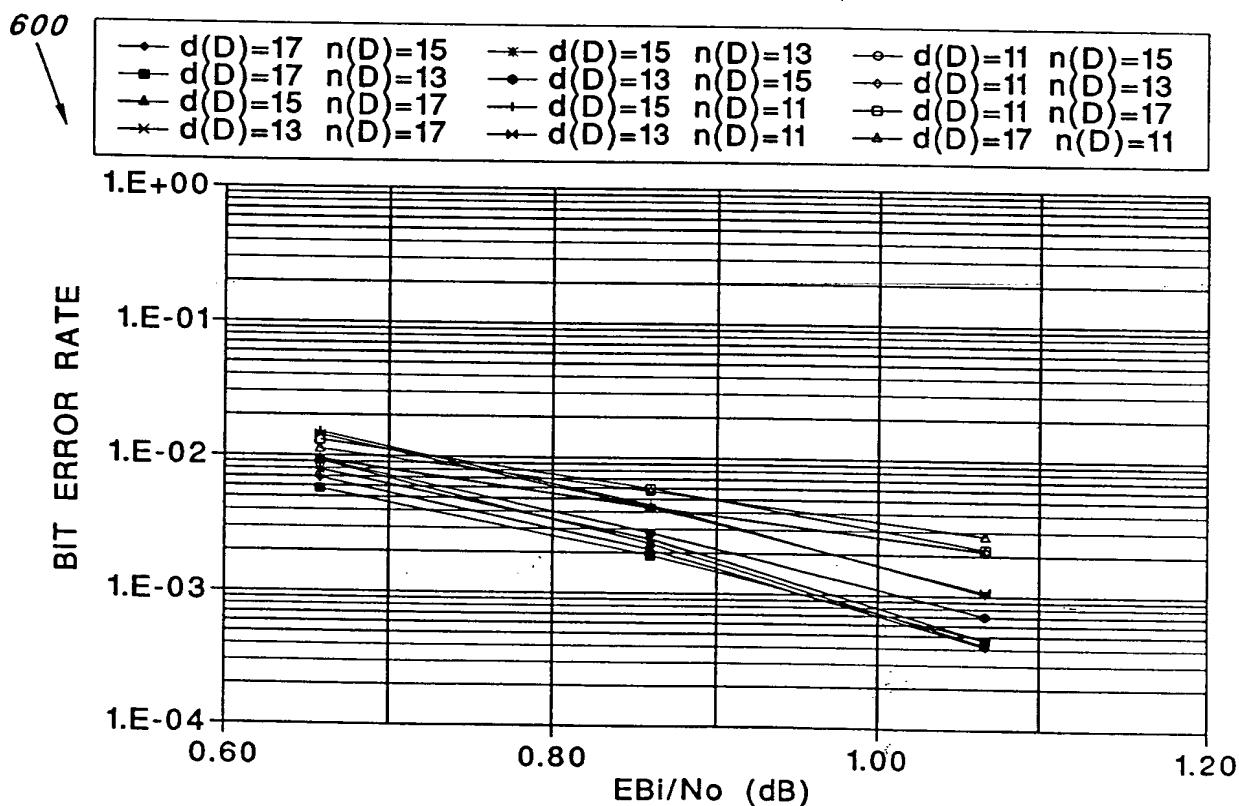


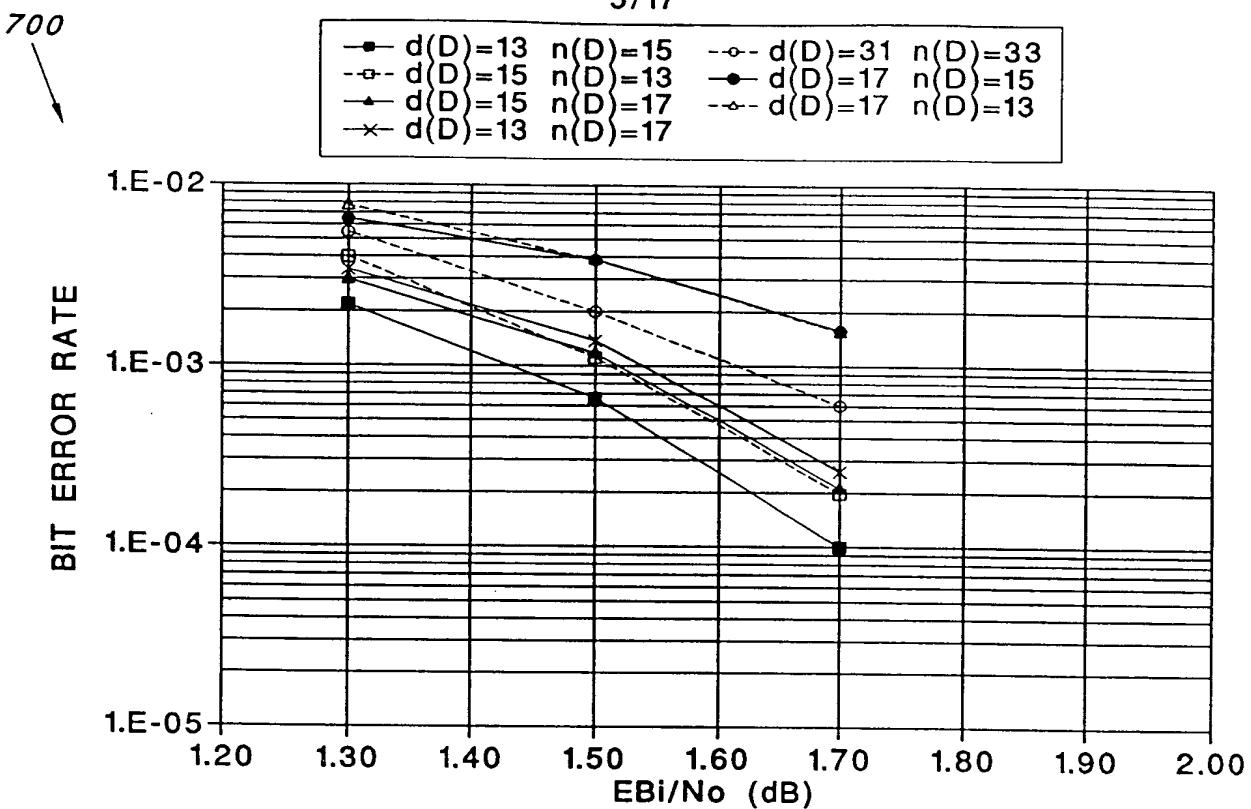
FIG. 4



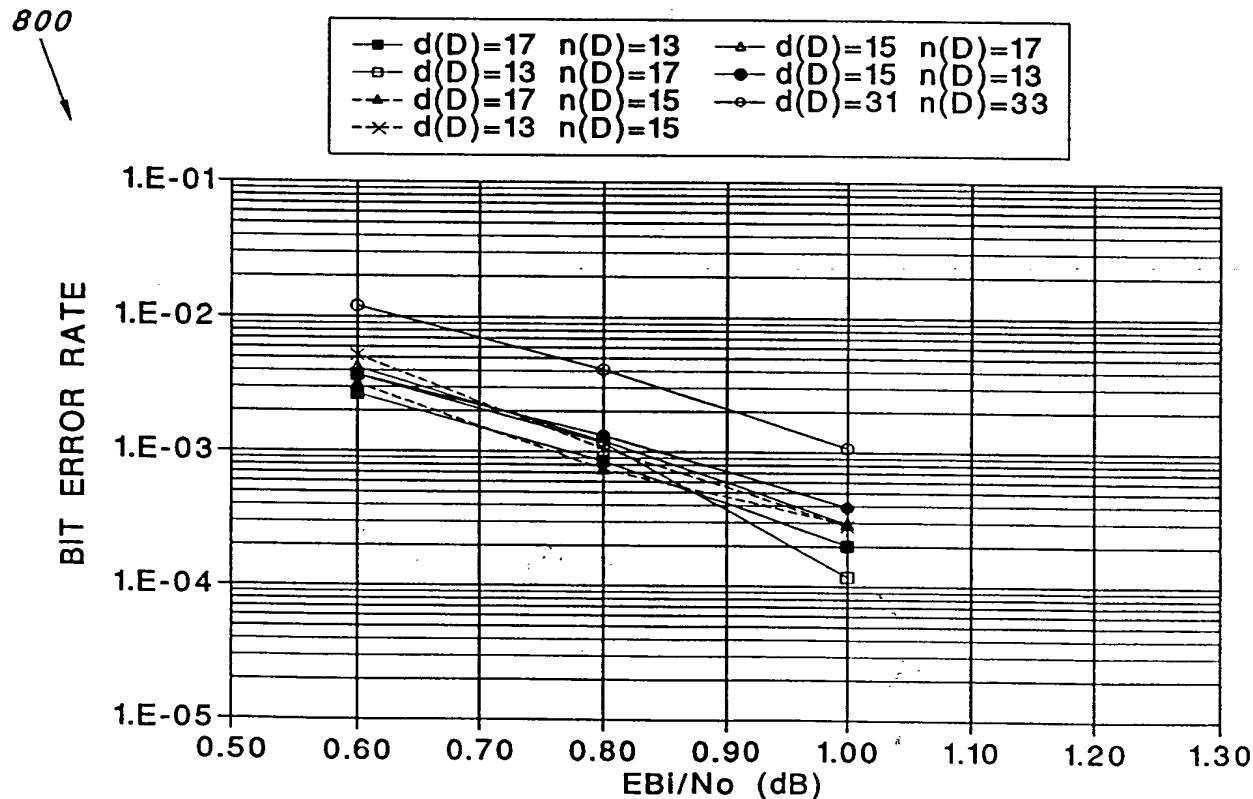
*FIG. 5 RATE-1/2 TURBO CODES ON AWGN CHANNEL.  
(1000 BIT INTERLEAVER, 3 ITERATIONS)*



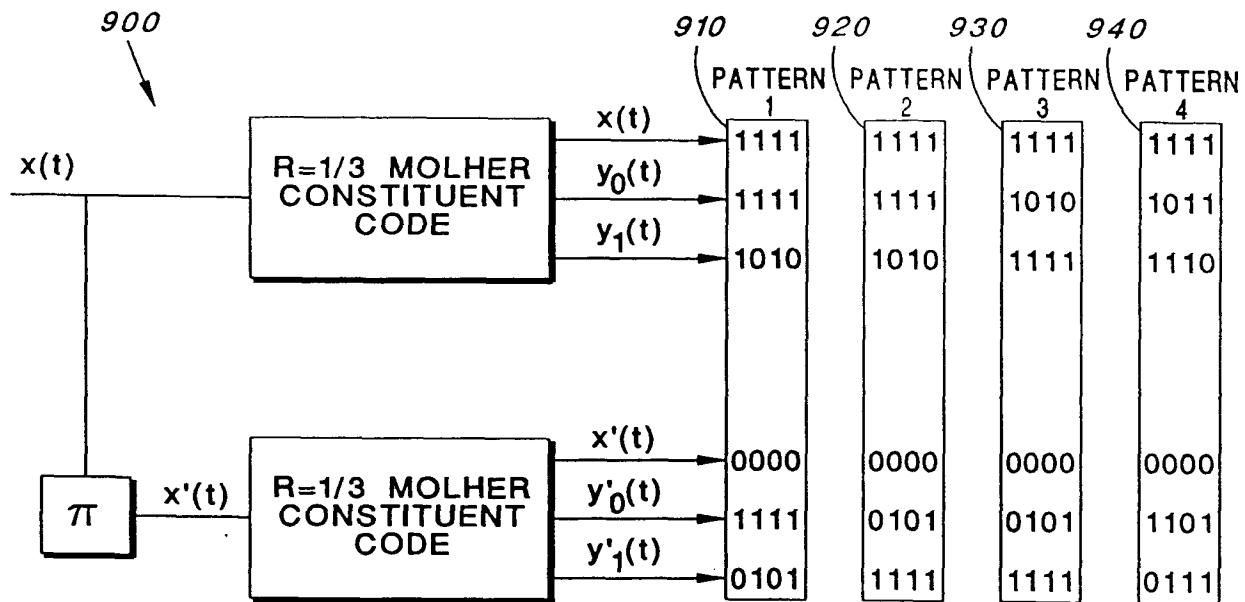
*FIG. 6 RATE-1/3 TURBO CODES ON AWGN CHANNEL.  
(1000 BIT INTERLEAVER, 3 ITERATIONS)*



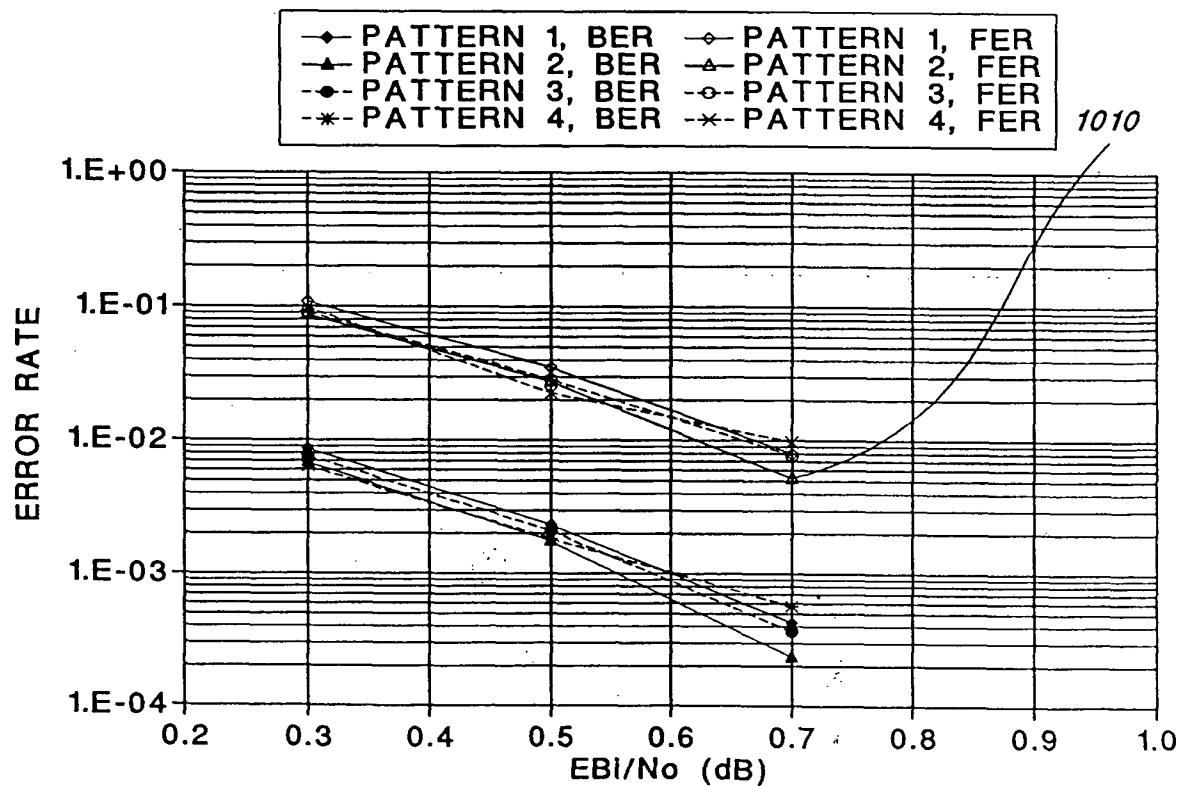
*FIG. 7* SELECTED RATE 1/2 TURBO CODES ON AWGN CHANNEL, 512 BIT FRAME SIZE



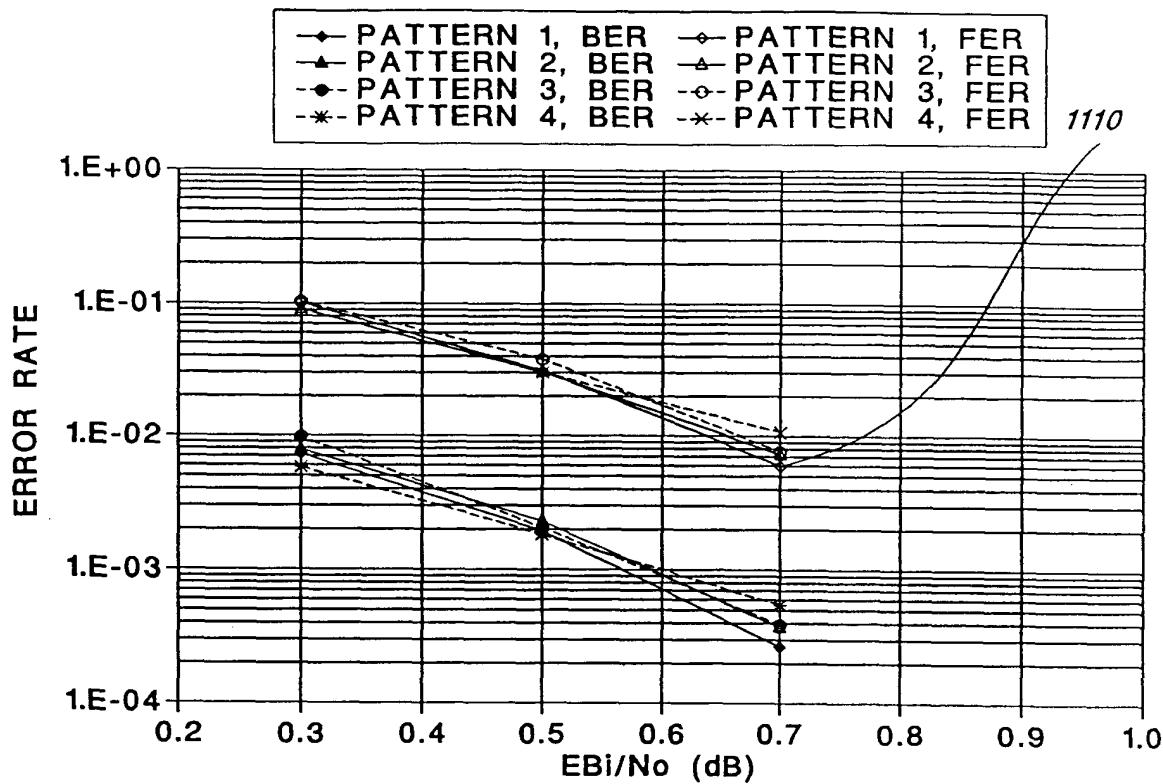
*FIG. 8* SELECTED RATE 1/3 TURBO CODES ON AWGN CHANNEL, 512 BIT FRAME SIZE



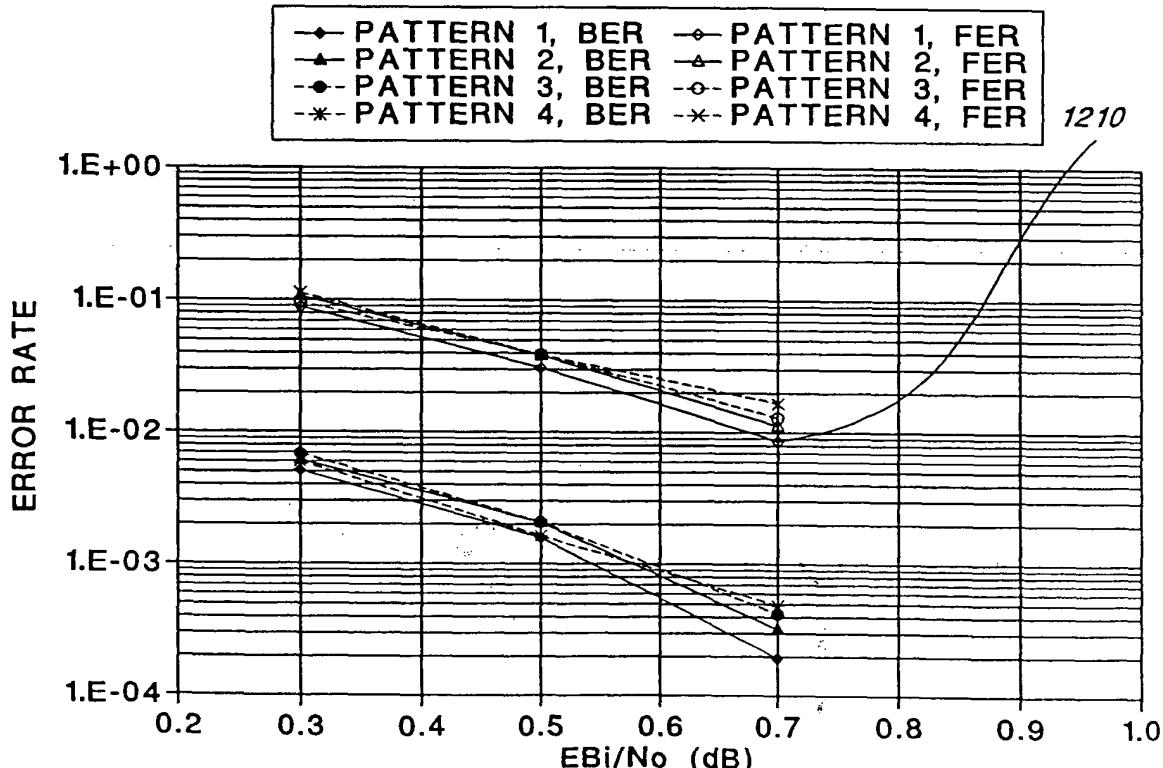
*FIG. 9* PUNCTURING SCHEMES STUDIED FOR OPTIMIZING THE RATE 1/4 TURBO CODE



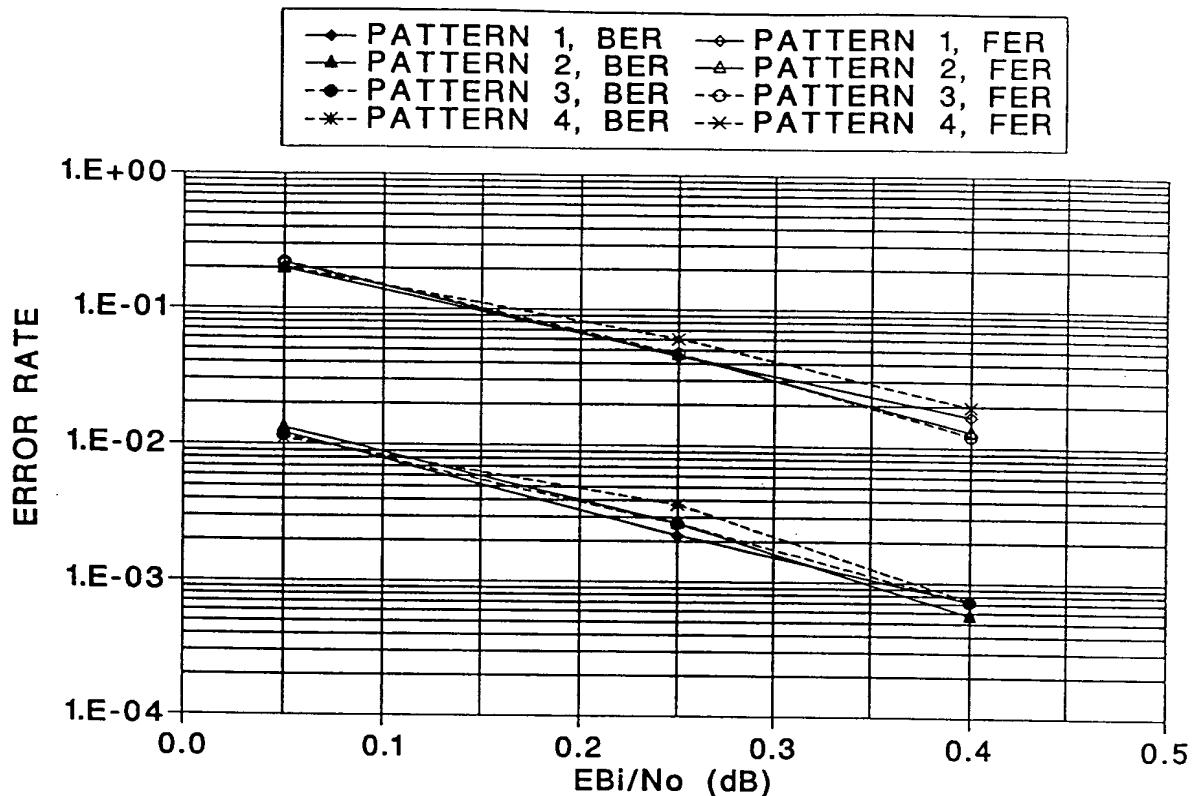
*FIG. 10* PERFORMANCE OF CODE #1,  
FRAME SIZE=512



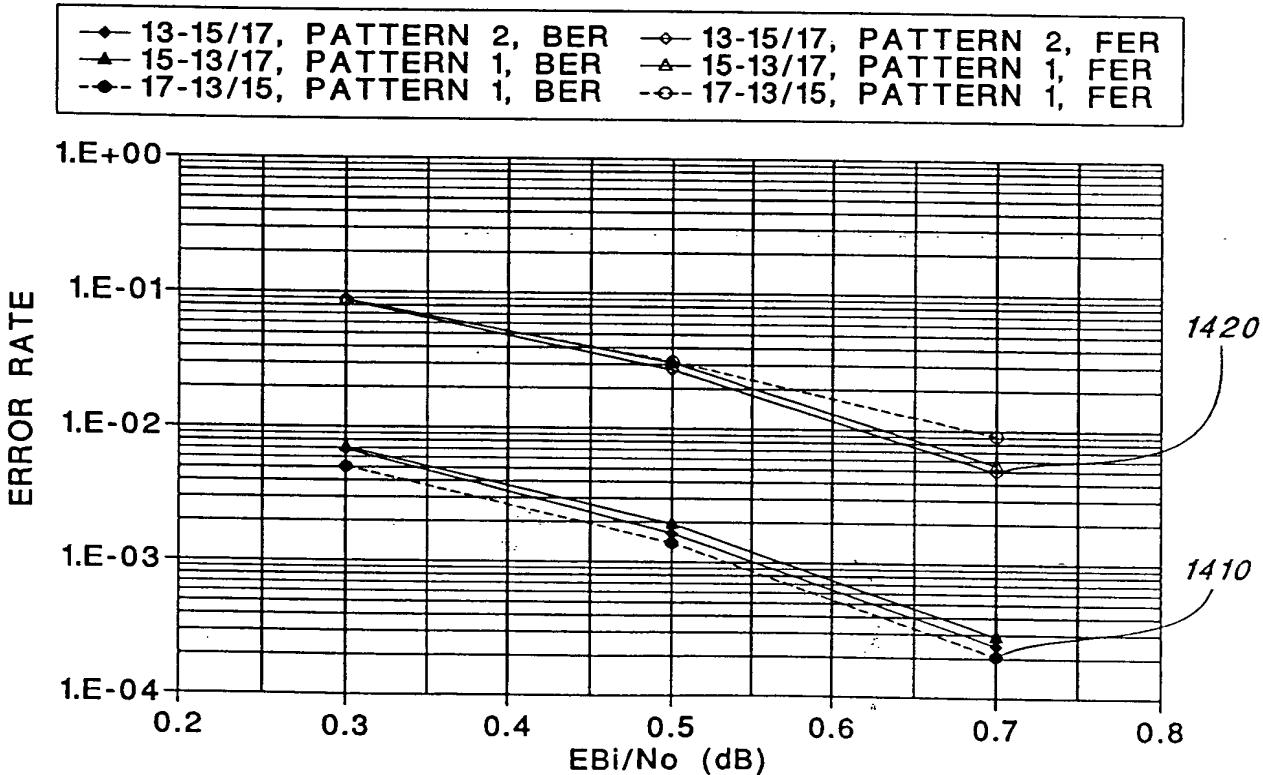
*FIG. 11* PERFORMANCE OF CODE #2,  
FRAME SIZE=512



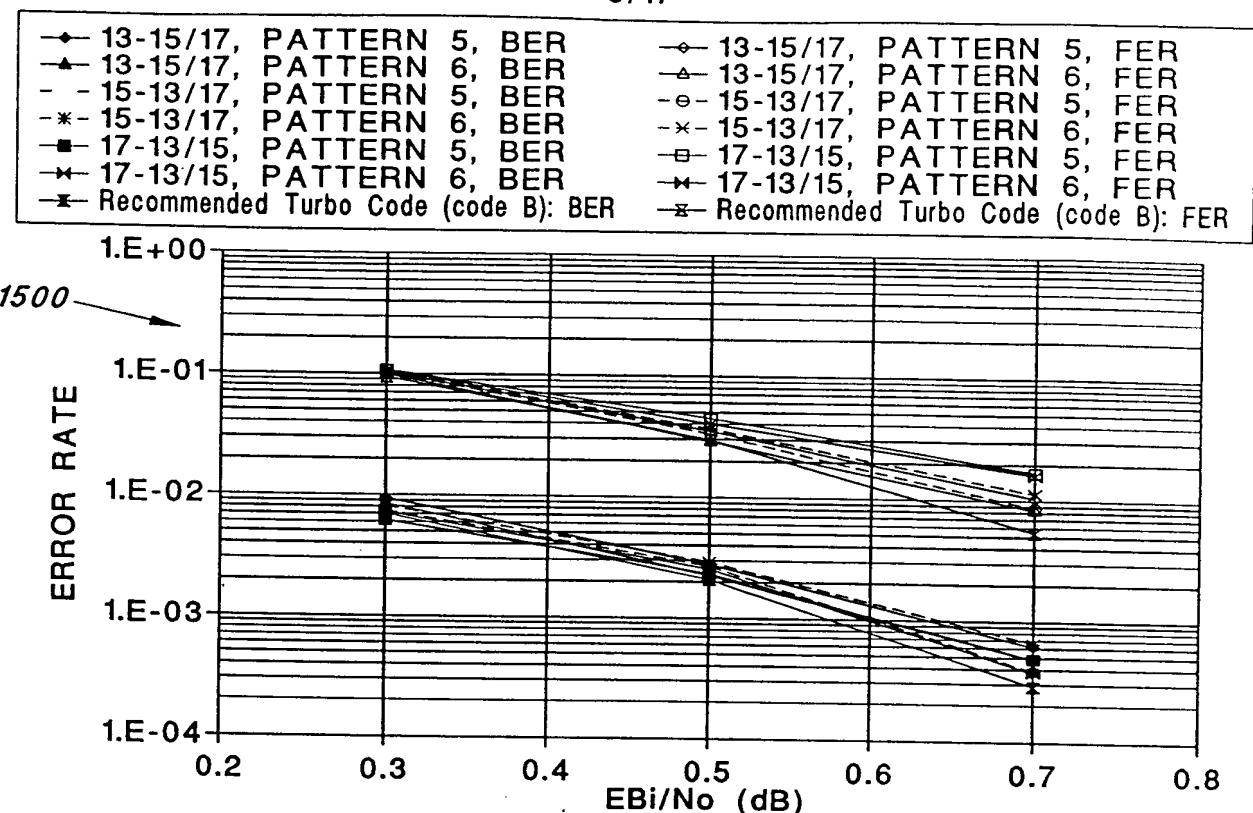
*FIG. 12* PERFORMANCE OF CODE #3,  
FRAME SIZE=512



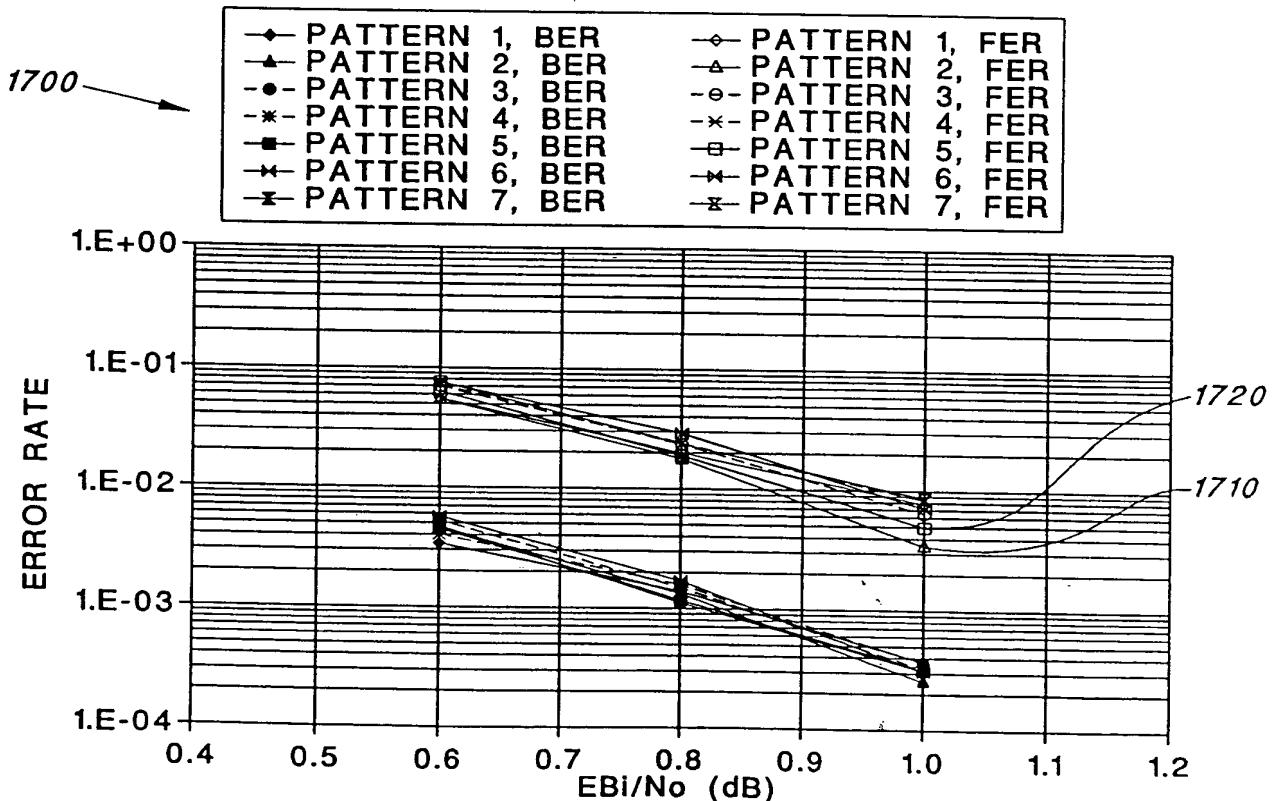
**FIG. 13** BER/FER PERFORMANCE OF CODE #1,  
FRAME SIZE=1024



**FIG. 14** BER/FER PERFORMANCE OF SELECTED  
RATE-1/4 TURBO CODES, FRAME SIZE=512



**FIG. 15** COMPARISON AGAINST OTHER PUNCTURING SCHEMES, FRAME=512



**FIG. 17** COMPARISON OF RATE 1/3 PUNCTURING SCHEMES, FRAME=512

	PATTERN 1	PATTERN 2	PATTERN 3	PATTERN 4	PATTERN 5	PATTERN 6	PATTERN 7
<u>1602</u>	<u>1604</u>	<u>1606</u>	<u>1608</u>	<u>1610</u>	<u>1612</u>	<u>1614</u>	<u>1616</u>
1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1
1 1 1 1	0 0 0 0	1 0 1 0	1 1 1 0	1 1 1 1	1 1 1 0	0 0 0 1	1 620
0 0 0 0	1 1 1 1	0 1 0 1	0 0 0 1	0 0 0 0	0 0 0 1	1 1 1 0	1 622
0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	1 624
1 1 1 1	0 0 0 0	1 0 1 0	0 0 0 1	0 0 0 0	1 1 1 0	0 0 0 1	1 626
0 0 0 0	1 1 1 1	0 1 0 1	1 1 1 1	1 1 1 1	1 1 1 0	0 0 0 1	1 628

(a) TURBO CODE RATE = 1/3

	PATTERN 1	PATTERN 2	PATTERN 3	PATTERN 4
<u>1640</u>	<u>1642</u>	<u>1644</u>	<u>1646</u>	
1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	
1 0 1 0	0 0 0 0	1 0 0 0	1 0 1 0	
0 0 0 0	1 0 1 0	0 0 1 0	0 0 0 0	
0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	
0 1 0 1	0 0 0 0	0 0 0 1	0 0 0 0	
0 0 0 0	0 1 0 1	0 1 0 0	0 1 0 1	

(b) TURBO CODE RATE = 1/2

## F/G. 16 ESSENTIAL PUNCTURING PATTERNS FOR RATE 1/3 COSTITUENT CODES

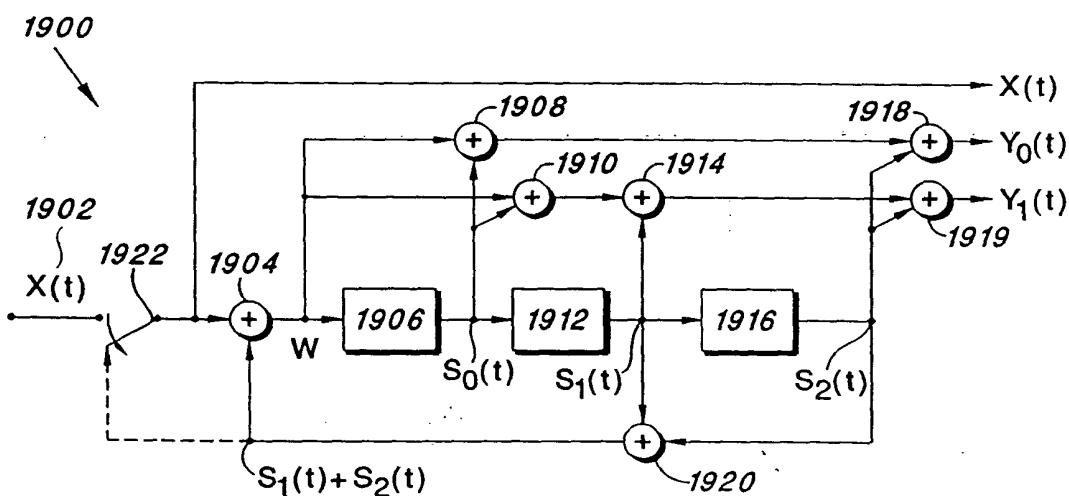
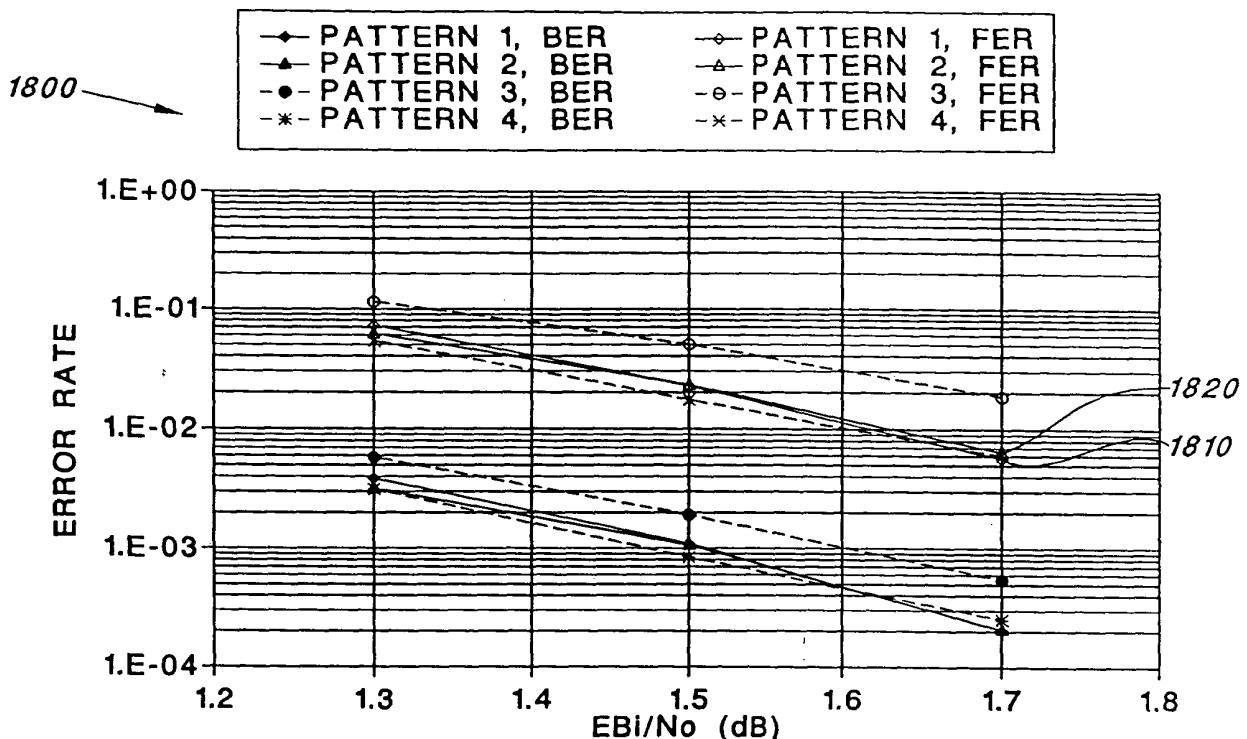
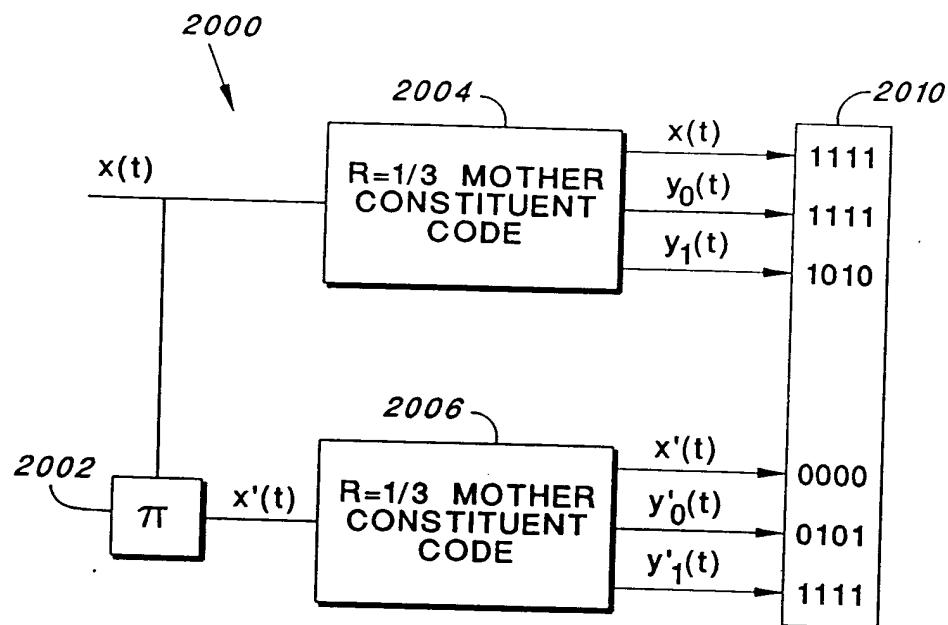
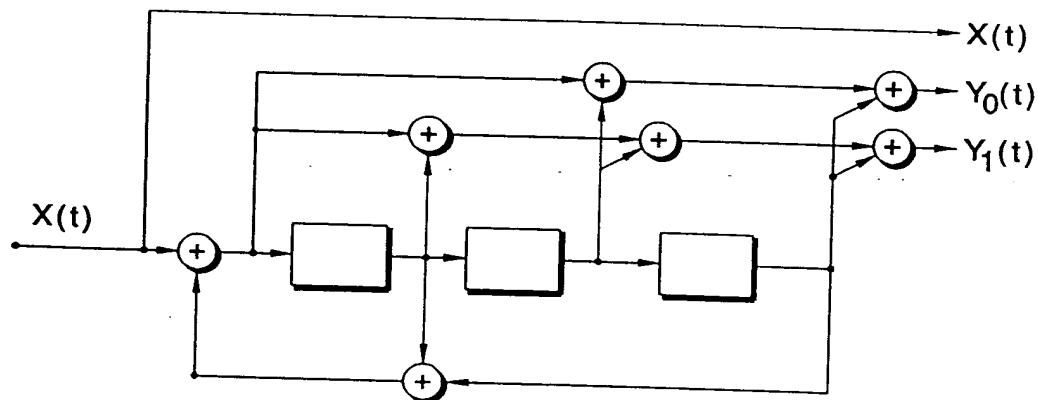


FIG. 19 UNIVERSAL CONSTITUENT ENCODER  
RECOMMENDED FOR FORWARD LINK TURBO  
CODES OF VARYING INTERLEAVER DEPTH



*FIG. 20* FORWARD LINK TURBO CODE OF RATE 1/4  
(MOTHER CODE IN FIGURE 19)



*FIG. 25* CONSTITUENT ENCODER FOR REVERSE-LINK TURBO CODE

PATTERN 1	PATTERN 2
111	111111
111	111110
000	000000
000	000000
110	110111
000	000000

PUNCTURING PATTERNS  
FOR RATE 3/8 FORWARD  
LINK CODES

*FIG. 21*

PATTERN 1	PATTERN 2
1111	11111111
1101	11011010
0000	00000000
0000	00000000
1010	10101101
0000	00000000

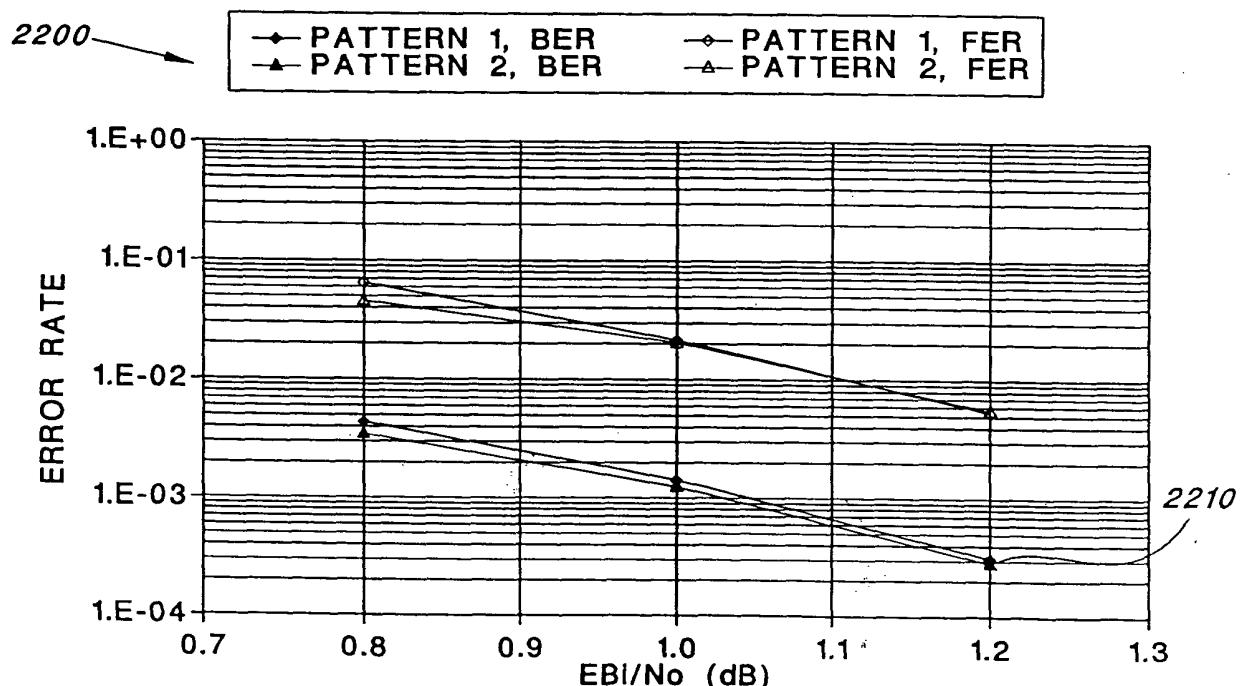
PUNCTURING PATTERNS  
FOR RATE 4/9 FORWARD  
LINK CODES

*FIG. 23*

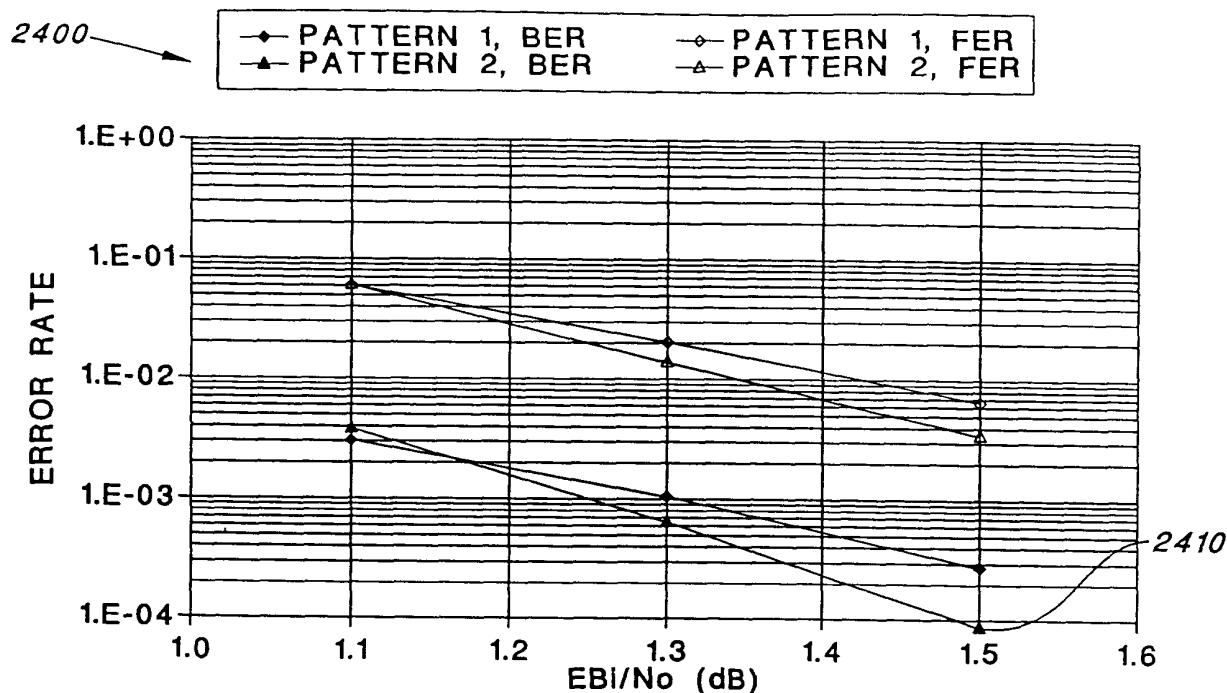
PATTERN 1	PATTERN 2	PATTERN 3
1111	1111	1111
1111	1011	1111
1011	1111	1011
0000	0000	0000
1111	1110	1110
1110	1111	1111

PUNCTURING PATTERNS FOR RATE 2/9 REVERSE LINK CODES

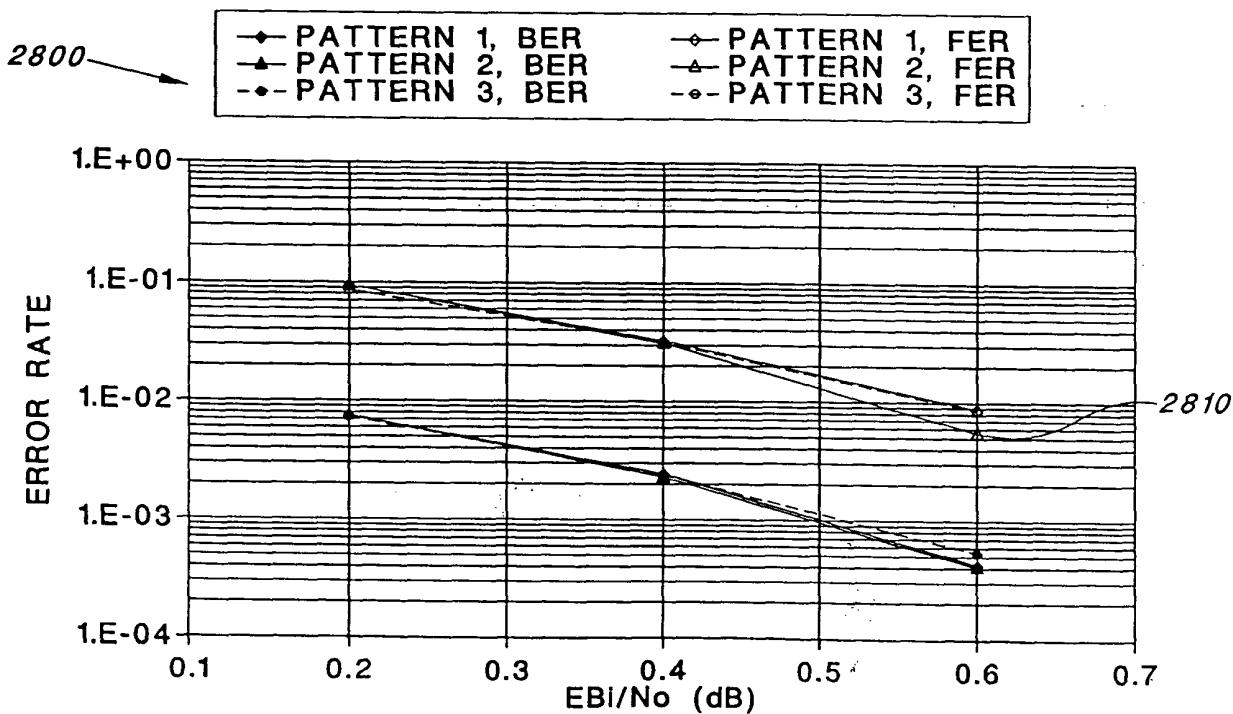
*FIG. 27*



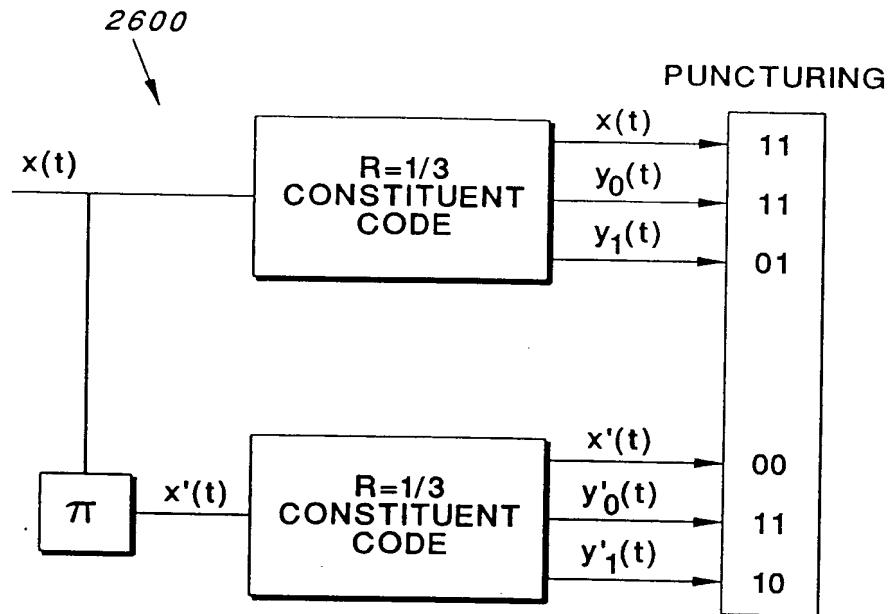
*FIG. 22* RATE 3/8 FORWARD LINK TURBO CODES,  
FRAME=512, AWGN CHANNEL



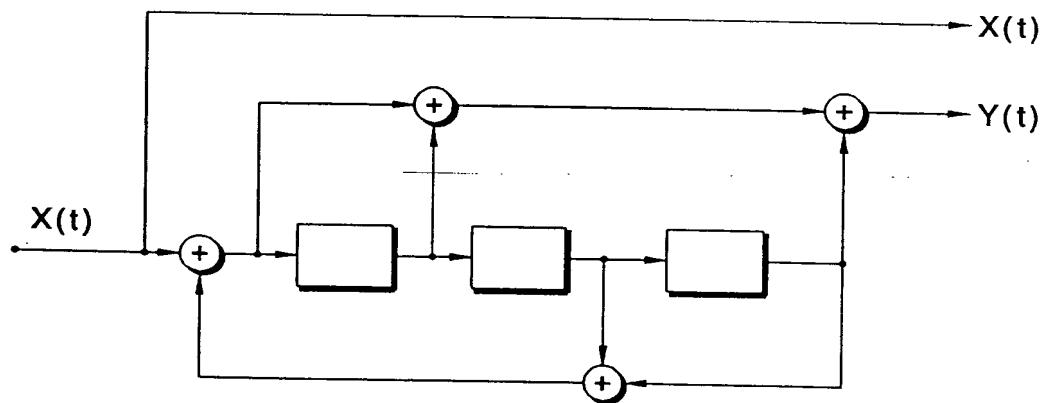
*FIG. 24* RATE 4/9 FORWARD LINK TURBO CODES,  
FRAME=512, AWGN CHANNEL



*FIG. 28* RATE 2/9 REVERSE LINK TURBO CODES,  
FRAME=512, AWGN CHANNEL



*FIG. 26* REVERSE LINK TURBO CODE OF RATE 1/4  
(MOTHER CODE IN FIGURE 25)



*FIG. 31* UNIVERSAL CONSTITUENT ENCODER  
RECOMMENDED FOR  $R=1/2$  AND  $R=1/3$  TURBO  
CODES OF VARYING INTERLEAVER DEPTH

16/17

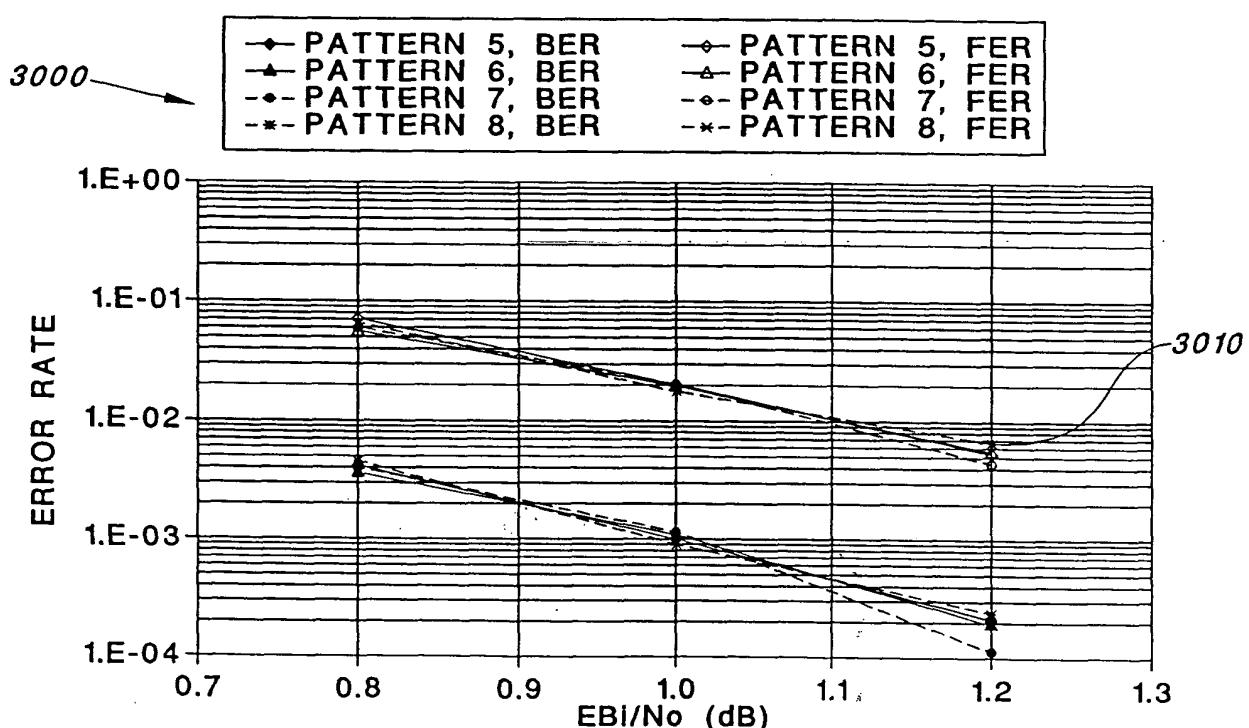
PATTERN 1	PATTERN 2	PATTERN 3
111	111	111
111	110	110
000	001	001
000	000	000
110	110	010
000	000	100

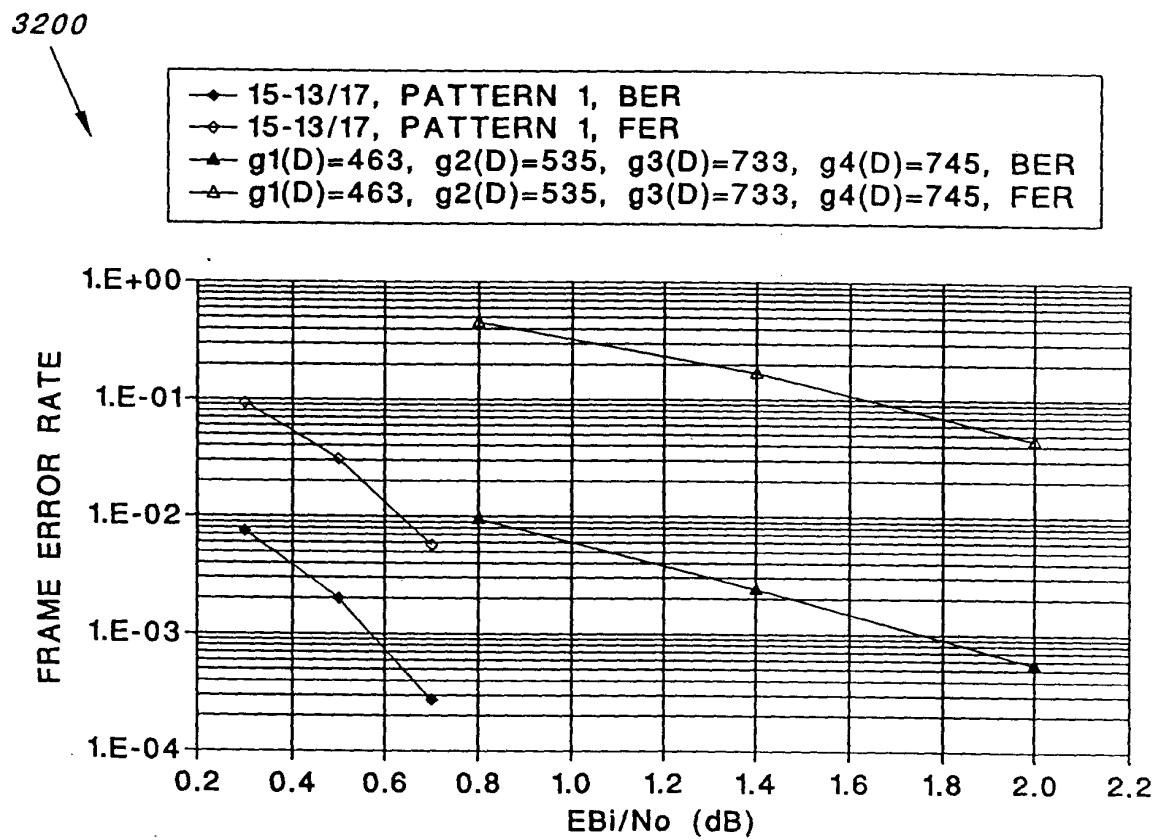
PATTERN 4	PATTERN 5	PATTERN 6
111	111	111
100	100	000
011	011	111
000	000	000
010	000	000
100	110	110

INITIAL PUNCTURING PATTERNS  
FOR RATE 3/8 REVERSE LINK CODES

*FIG. 29*



*FIG. 30* RATE 3/8 REVERSE LINK TURBO CODES,  
FRAME=512, AWGN CHANNEL



*FIG. 32*

COMPARISON OF RATE 1/4 FER-OPTIMIZED TURBO CODE VS CONVOLUTIONAL CODE, FRAME SIZE=512